CLAIMS

What is claimed is:

1. An optical apparatus, comprising:
   - a) an input port, providing a multi-wavelength optical signal;
   - b) a polarization-separating element that decomposes said multi-wavelength optical signal into first and second polarization components;
   - c) a polarization-rotating element that rotates a polarization of said second polarization component by approximately 90-degrees;
   - d) a wavelength-disperser that separates said first and second polarization components by wavelength into first and second sets of optical beams, respectively; and
   - e) an array of optical power sensors, positioned to receive said first and second sets of optical beams.

2. The optical apparatus of claim 1 further comprising an auxiliary polarization-rotating element, such that said first and second sets of optical beams are polarized in two orthogonal directions upon impinging on said array of optical power sensors.

3. The optical apparatus of claim 2 wherein said auxiliary polarization-rotating element is disposed between said wavelength-disperser and said array of optical power sensors.

4. The optical apparatus of claim 3 wherein said auxiliary polarization-rotating element is configured such that said second set of optical beams undergoes a rotation in polarization of approximately 90-degrees.

5. The optical apparatus of claim 3 wherein said auxiliary polarization-rotating element is configured such that said first set of optical beams undergoes a rotation in polarization of approximately 90-degrees.

6. The optical apparatus of claim 2 wherein said auxiliary polarization-rotating element comprises an element selected from the group consisting of half-wave plates, Faraday rotators, and liquid crystal rotators.

7. The optical apparatus of claim 1 wherein said polarization-separating element comprises an element selected from the group consisting of polarizing beam splitters and birefringent beam displacers.

8. The optical apparatus of claim 1 wherein said polarization-rotating element comprises an element selected from the group consisting of half-wave plates, Faraday rotators, and liquid crystal rotators.

9. The optical apparatus of claim 1 wherein said array of optical power sensors comprises a photodiode array.

10. The optical apparatus of claim 1 wherein said wavelength-disperser comprises an element selected from the group consisting of ruled diffraction gratings, holographic gratings, echelle gratings, curved diffraction gratings, transmission gratings, and dispersing prisms.

11. The optical apparatus of claim 1 further comprising a beam-focuser for focusing said first and second sets of optical beams into corresponding focused spots.

12. The optical apparatus of claim 11 wherein said beam-focuser comprises at least one focusing lens.

13. The optical apparatus of claim 1 wherein said input port comprises a fiber collimator.

14. An optical apparatus, comprising:

a) an input port, providing a multi-wavelength optical signal;

b) a polarization-separating element that decomposes said multi-wavelength optical signal into first and second polarization components;

c) a polarization-rotating element that rotates a polarization of said second polarization component by approximately 90-degrees;

d) a wavelength-disperser that separates said first and second polarization components by wavelength into first and second sets of optical beams respectively; and

e) an array of optical power sensors, positioned to receive said first and second sets of optical beams;

wherein said optical apparatus further comprises a modulation assembly, which is adapted to modulate said first and second sets of optical beams prior to impinging onto said array of optical power sensors.

15. The optical apparatus of claim 14 wherein said modulation assembly is adapted to cause said first and second sets of optical beams to impinge onto said array of optical power sensors in a time-division-multiplexed sequence.

16. The optical apparatus of claim 15 wherein said modulation assembly comprises first and second shutter-elements.

17. The optical apparatus of claim 16 wherein said first shutter-element comprises an element selected from the group consisting of liquid crystal based shutter elements and MEMS based shutter elements.

18. The optical apparatus of claim 17 wherein said second shutter-element comprises an element selected from the group consisting of liquid crystal based shutter elements and MEMS based shutter elements.

19. The optical apparatus of claim 16 further comprising a control unit, in communication with said first and second shutter-elements.

20. The optical apparatus of claim 14 wherein said modulation assembly comprises first and second modulating elements, adapted to cause said first and second sets of optical beams to carry distinct dither modulation signals upon impinging onto said array of optical power sensors.

21. The optical apparatus of claim 20 wherein said first modulating element comprises an electro-optic intensity modulator.

22. The optical apparatus of claim 21 wherein said second modulating element comprises an electro-optic intensity modulator.

23. The optical apparatus of claim 20 further comprising a control unit, in communication with said first and second modulating elements.

24. The optical apparatus of claim 20 further comprising a synchronous detection unit, configured to detect said dither modulation signals.

25. The optical apparatus of claim 14 wherein said modulation assembly comprises an optical beam-chopper.

26. The optical apparatus of claim 14 wherein said modulation assembly is in optical communication with said polarization-separating element along with said polarization-rotating element and said wavelength-disperser, thereby controlling said first and second polarization components.

27. The optical apparatus of claim 14 wherein said modulation assembly is in optical communication with said wavelength-disperser and said array of optical power sensors, so as to control said first and second sets of optical beams.

28. The optical apparatus of claim 14 wherein said polarization-separating element comprises an element selected from the group consisting of polarizing beam splitters and birefringent beam displacers.

29. The optical apparatus of claim 14 wherein said polarization-rotating element comprises an element selected from the group consisting of half-wave plates, Faraday rotators, and liquid crystal rotators.

30. The optical apparatus of claim 14 wherein said array of optical power sensors comprises a photodiode array.

31. The optical apparatus of claim 14 wherein said wavelength-disperser comprises an element selected from the group consisting of ruled diffraction gratings, holographic gratings, echelle gratings, curved diffraction gratings, transmission gratings, and dispersing prisms.

32. The optical apparatus of claim 14 wherein said input port comprises a fiber collimator.

33. The optical apparatus of claim 14 further comprising a beam-focuser for focusing said first and second sets of optical beams into corresponding focused spots.

34. The optical apparatus of claim 33 wherein said beam-focuser comprises at least one focusing lens.

35. A method of optical spectral power monitoring using a polarization diversity scheme, comprising:

a) providing a multi-wavelength optical signal;

b) decomposing said multi-wavelength optical signal into first and second polarization components;

c) rotating a polarization of said second polarization component by approximately 90-degrees;

d) separating said first and second polarization components by wavelength respectively into first and second sets of optical beams; and

e) impinging said first and second sets of optical beams onto an array of optical power sensors.

36. The method of claim 35 further comprising the step of rotating a polarization of said second set of optical beams each by approximately 90-degrees, prior to impinging onto said array of optical power sensors.

37. The method of claim 35 further comprising the step of rotating a polarization of said first set of optical beams each by approximately 90-degrees, prior to impinging onto said array of optical power sensors.

38. The method of claim 35 further comprising the step of modulating said first and second sets of optical beams, respectively.

39. The method of claim 38 wherein said first and second sets of optical beams are modulated to impinge onto an array of optical power sensors in a time-division-multiplexed sequence.

40. The method of claim 38 wherein said first and second sets of optical beams are modulated to carry distinct dither modulation signals, upon impinging onto said array of optical power sensors.

41. The method of claim 40 further comprising the step of performing synchronous detection of said dither modulation signals.